Printed Pages : 7

TEC-101

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3033 Roll No.

B. Tech.

(SEM. I) EXAMINATION, 2007-08

ELECTRONICS ENGINEERING

Time : 3 Hours] *[Total Marks : 100*

Note : *Attempt all questions.*

1 Attempt any four parts of the following : **5×4=20**

(a) What is the difference between an intrinsic and an extrinsic semiconductor ? Define a hole in a semiconductor.

(b) Define :

(1) Donor and acceptor impurities

(2) Mobility and conductivity.

(c) Estimate the relative concentration of germanium atoms and electron hole pairs at 300 K (room temperature). Also predict the intrinsic resistivity. Given atomic weight of germanium, 72.60 g/g-atom, $e=1.6\times10^{-19}$ coulombs intrinsic concentration (at 300 K) 2.4×10^{19} electron-hole pairs/m^3. Density for germanium $= 5.32\times10^6$ g/m^3. Electron mobility = 0.39, hole mobility = 0.19.

(d) Determine the number of atoms of aluminium (Al) in cubic meter. Then find the average drift velocity in an Al conductor with a cross-sectional area of 1 cm^2 carrying a current of 1A.

Given : Atomic weight of Al = 26.98 g/g-atom, density of Al = 2.7×10^6 g/m^3.

(e) Explain (i) How does the reverse saturation current of a p-n diode vary with temperature ? (ii) How does the diode voltage (at constant current) vary with temperature ?

(f) Sketch the piece wise linear characteristics of a diode. What are the approximate cut in voltages for silicon and germanium ?

2 Attempt any two parts of the following :

(a) Sketch the circuit for a full-wave rectifier using two diodes only. Derive the expression for (i) the dc current, (ii) the dc load voltage, (iii) the dc diode voltage, (iv) the rms current.

(b) A full wave rectifier with a centre-tapped transformer supplies a dc current of 100 mA to a load resistance of $R = 20\ \Omega$. The secondary resistance of transformer is $1\ \Omega$. Each diode has a forward resistance of $0.5\ \Omega$.

Determine following :

(1) rms value of the signal voltage across each half of the secondary

(2) dc power supplied to the load

(3) PIV rating for each diode

(4) ac power input to the rectifier

(5) conversion efficiency.

(c) Explain clipping and clamping circuits in detail. For the Zever regulator circuits of Fig. 1 determine the range of input voltage (V_s) for the zener diode to remain in "ON" state. Given : Zener diode; $V_z = 20\ V$, $I_z(\max) = 50\ mA$, $R_z = 0$.

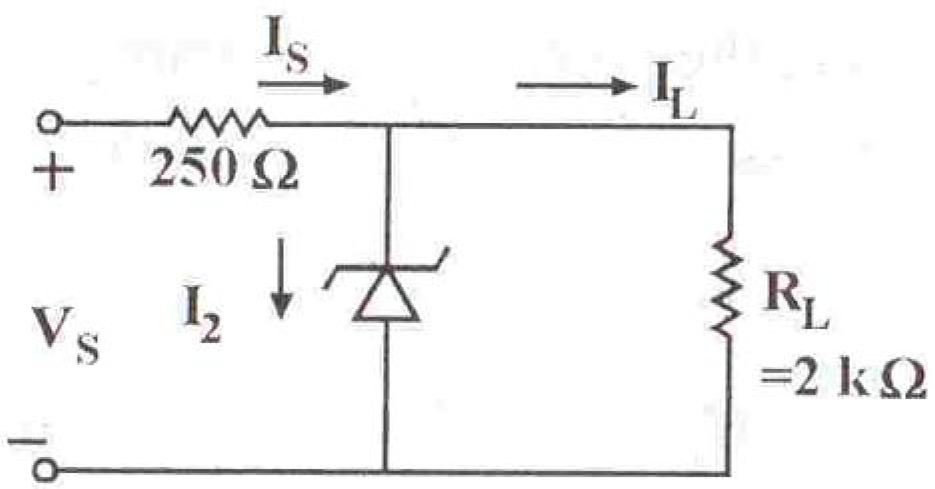

Fig. 1

3 Attempt any two parts of the following :

(a) Draw the circuit of transistor in the CE configuration. Sketch the output characteristics. Indicate the active, saturation and cut off region. Explain each region in detail.

(b) How BJT works as a switch ? Consider the transistor circuit of **Fig. 2** which has a resistance included between emitter and ground. Show that the transistor is operating in active mode. Calculate I_C, I_E and I_B. Given : $\beta = 50$.

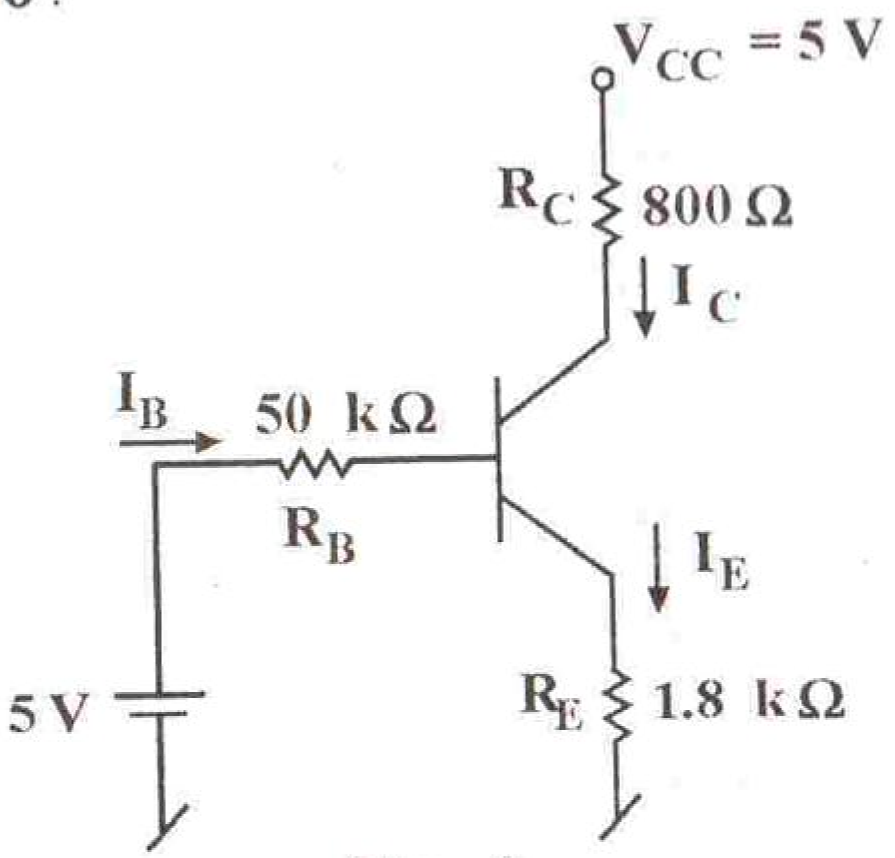

Fig. 2

(c) Using the approximate h-parameter model, obtain the expression for a CE circuit for

(1) A_i

(2) R_i

(3) A_v

(4) R_0.

4 Attempt any two parts of the following :

(a) How is an FET used as a voltage - variable resistance ? Define : (1) transconductance g_m; (2) drain resistance r_d; (3) amplification factor μ of an FET.

(b) An n-channel JFET, having $V_p = -4V$ and $I_{DSS} = 10\ mA$, is used in the circuit of Fig. 3. The parameter values are $V_{DD} = 18\ V$, $R_S = 2\ k\Omega$, $R_D = 2\ k\Omega$, $R_1 = 450\ k\Omega$ and $R_2 = 90\ k\Omega$. Determine I_D and V_{DS}.

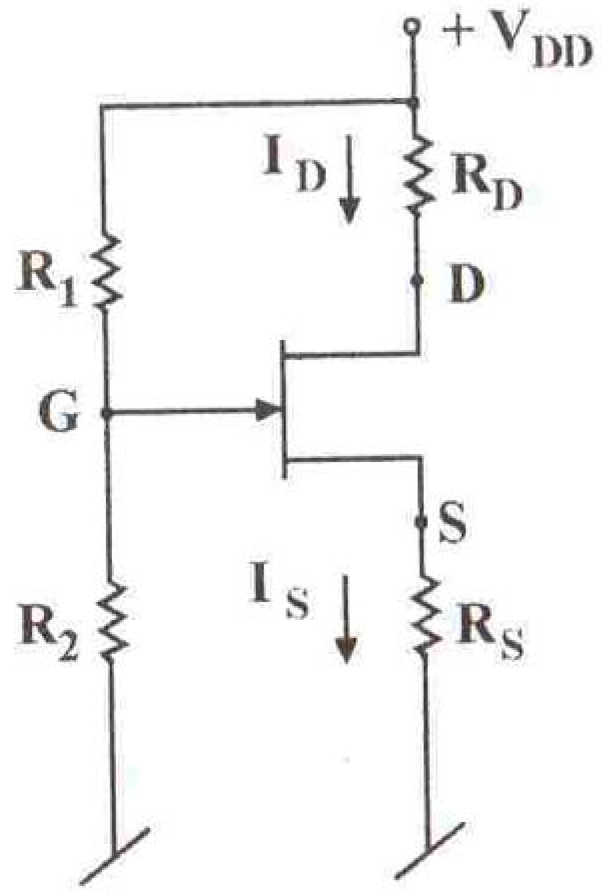

Fig. 3

(c) Consider the n-channel enhancement MOSFET shown in Fig. 4. If $V_T = 4V$ and $I_D = 1.28$ mA at $V_{GS} = 12V$, determine the value of R_D for operation at $V_{DS} = 8\ V$.

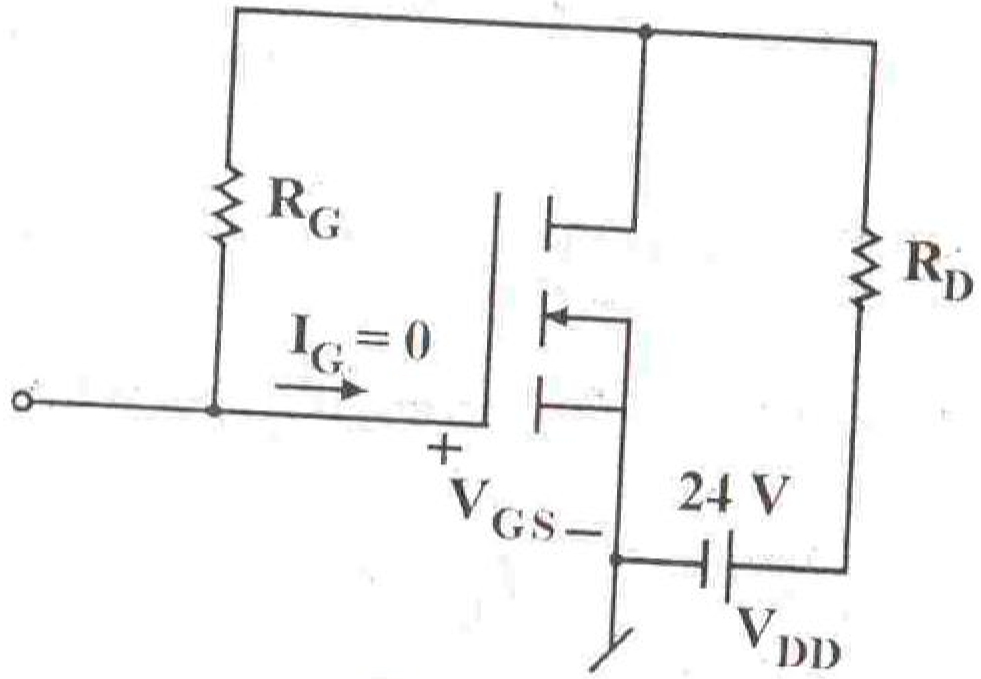

Fig. 4

Explain concept of pinch off.

5 Attempt any two parts of the following :

(a) List characteristics of the ideal opamp. For the opamp circuit shown in Fig. 5. Find the values of R_1 and R_2 for the output to be

$$v_0 = -5\,v_a + 3\,v_b$$

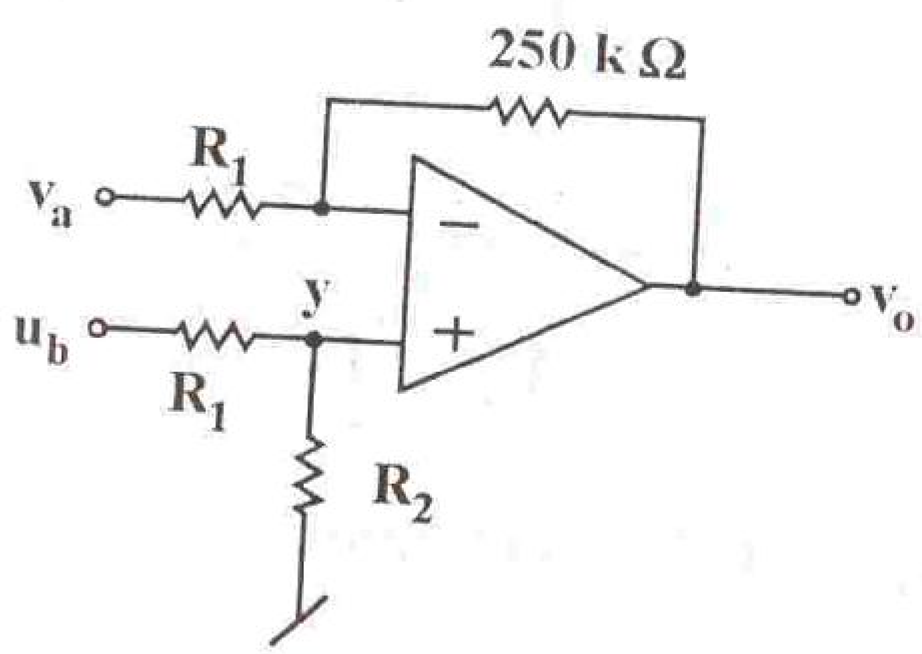

Fig. 5

(b) Write short notes : 04

(1) Investing and noninvesting OPAMP

(2) CMRR

(3) Minterms and maxterms

(4) BCD code and excess-3 code.

(c) (1) Given the boolean function 4

$$Y = (A + \bar{B}C)(C + AB)$$

Design a circuit using AND and OR gates to realize the above function.

(2) Convert the following : 2

$$(1010.101)_{10} \rightarrow (\quad)_2 \rightarrow (\quad)_4$$

$$(C3A.47)_H \rightarrow (\quad)_8 \rightarrow (\quad)_2$$

(3) Minimise the following using K-map : 4

$$f(a, b, c, d) = \sum m(0, 1, 3, 4, 7, 9, 10, 14, 15)$$